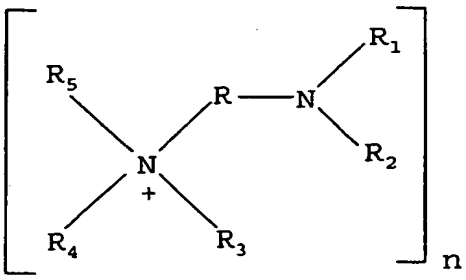
CLAIMS

1. Tyre for vehicle wheels, comprising at least one structural element including an elastomeric composition comprising:

(a) at least one diene elastomeric polymer;

(b) at least one organic quaternary ammonium salt having the following general formula (I):



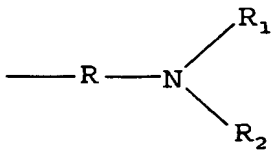
X^{n-} (I)

wherein:

- R represents a linear or branched C_1-C_{22} alkylene group; a linear or branched C_2-C_{22} alkenylene group; a C_6-C_{18} arylene group; a C_7-C_{20} alkylarylene or alkylenearylene group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur;
- R_1 and R_2, which may be identical or different, represent a linear or branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_2, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic

ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_5 and/or R_2 and R_3, considered jointly with the nitrogen atoms to which they are linked, represent a C_5-C_{18} heterocyclic ring;

- R_3, R_4 and R_5, which may be identical or different, represent a linear or branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; a group having the following formula:



wherein R, R_1 and R_2, have the same meanings as disclosed above; or two from R_3, R_4 and R_5, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur;

- X^{n-} represents an inorganic or organic anion group;
- n represents 1, 2 or 3.

2. Tyre according to claim 1, comprising:

- a carcass structure with at least one carcass ply shaped in a substantially toroidal configuration, the opposite lateral edges of which are associated with respective right-hand and left-hand bead wires, each bead wire being enclosed in a

respective bead;

- a belt structure comprising at least one belt strip applied in a circumferentially external position relative to said carcass structure;
- a tread band superimposed circumferentially on said belt structure;
- a pair of side walls applied laterally on opposite sides relative to said carcass structure;

wherein said structural element which includes said elastomeric composition is the tread band.

3. Tyre according to claim 1 or 2, wherein the elastomeric composition is substantially free of additional secondary accelerators.

4. Tyre according to claim 3, wherein the secondary accelerator is diphenyl guanidine (DPG).

5. Tyre according to any one of the preceding claims, wherein X^{n-} is selected from: halide ions such as iodine, bromine, fluorine, or chlorine ions; ipoiodite ion; ipobromite ion; fluorite ion; chlorite ion; iodite ion; bromite ion; fluorine ion; chlorite ion; iodate ion; bromate ion; fluorate ion; chlorate ion; periodate ion; perbromate ion; perfluorate ion; perchlorate ion; nitrate ion; nitrite ion; sulfate ion; sulfite ion; phosphate ion; phosphite ion; hydroxide ion; or an anion group represented by the following formulae (II) to (V):

$$R_6COO^- \quad (II)$$

wherein R_6 represents a linear or branched C_1-C_{18} alkyl group; a linear or branched C_2-C_{18} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one of the following groups:

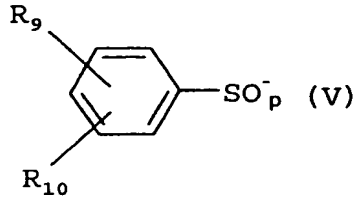
hydroxyl group, carbonyl group, ether group, thioether group, ester group;

$$^{-}OCO-(R_7)_m-COO^{-} \quad (III)$$

wherein m represents 0 or 1; R_7 represents a linear or branched C_1-C_{18} alkylene group; a linear, branched or cyclic C_2-C_{18} alkenylene group; a C_6-C_{18} arylene group; a C_7-C_{20} arylalklylene or alkylarylene group; said groups optionally containing at least one of the following groups: hydroxyl group, carbonyl group, ether group, thioether group, ester group;

$$R_8SO_p^{-} \quad (IV)$$

wherein p represent 3 or 4; R_8 represents a linear or branched C_1-C_{18} alkyl group; a linear or branched C_2-C_{18} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one of the following groups: hydroxyl group, carbonyl group, ether group, thioether group, ester group;



(V)

wherein p represents 3 or 4; R_9 and R_{10}, which may be identical or different, represent a hydrogen atom; a linear or branched C_1-C_{18} alkyl group; a linear or branched C_2-C_{18} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one of the following groups: hydroxyl group, carbonyl group, ether group, thioether group, ester group.

6. Tyre according to any one of the preceding claims, wherein R and R_7 groups are: methylene, ethylene, propylene, butylene, 2,2-dimethyl-1,3-propylene, hexylene, 2-methyl-3-ethyl-1,4-butylene, octylene, vinylene, butenylene, isobutenylene, pentenylene, hexenylene, phenylene, naphtylene, diphenylene, benzenylene, phenylmethylene, phenylethylene, naphtylmethylene, naphtylethylene, methylphenylene, ethylphenylene, methylnaphthylene, ethylnaphthylene.

7. Tyre according to any one of the preceding claims, wherein R_1, R_2, R_3, R_4, R_5, R_6, R_8, R_9 and R_{10} groups are: methyl, ethyl, propyl, isopropyl, butyl, isobutyl, pentyl, hexyl, octyl, allyl, methallyl, 2-butenyl, propenyl, hexenyl, octenyl, benzyl, phenyl, naphthyl, methylbenzyl, ethylbenzyl, diphenyl, methylphenyl, ethylphenyl, methylnaphthyl, ethylnaphthyl.

8. Tyre according to any one of the preceding claims, wherein R_1 and R_2 considered jointly with the nitrogen atom to which they are linked are: morpholine, pyrrolidine, piperidine, N-methyl-piperidine, piperazine, thiomorpholine, thiazolidine, benzothiazolidine, imidazole.

9. Tyre according to any one of the preceding claims, wherein R_1 and R_5 and/or R_2 and R_3 considered jointly with the nitrogen atom to which they are linked are: piperazine, 1,8-diazabicyclo[2.2.2]octane.

10. Tyre according to any one of the preceding claims, wherein the heterocyclic rings in the case wherein two from R_3, R_4 and R_5, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring are:

pyrrolidinium, piperidinium, piperazinium, imidazolium.

11. Tyre according to any one of the preceding claims, wherein the organic quaternary ammonium salt (b) is present in the elastomeric composition in an amount of from 0.1 phr to 10 phr.

12. Tyre according to claim 11, wherein the organic quaternary ammonium salt (b) is present in the elastomeric composition in an amount of from 0.5 phr to 5 phr.

13. Tyre according to any one of the preceding claims, wherein the diene elastomeric polymer (a) has a glass transition temperature (T_g) below 20°C.

14. Tyre according to claim 13, wherein the diene elastomeric polymer (a) is selected from: cis-1,4-polyisoprene, 3,4-polyisoprene, polybutadiene, optionally halogenated isoprene/isobutene copolymers, 1,3-butadiene/acrylonitrile copolymers, styrene/1,3-butadiene copolymers, styrene/isoprene/1,3-butadiene copolymers, styrene/1,3-butadiene/acrylonitrile copolymers, or mixtures thereof.

15. Tyre according to any one of the preceding claims, wherein the elastomeric composition comprises at least one elastomeric polymer of one or more monoolefins with an olefinic comonomer or derivatives thereof (a').

16. Tyre according to claim 15, wherein the elastomeric polymer (a') is selected from: ethylene/propylene copolymers (EPR) or ethylene/propylene/diene copolymers (EPDM); polyisobutene; butyl rubbers; halobutyl rubbers;

or mixtures thereof.

17. Tyre according to any one of the preceding claims, wherein the elastomeric composition comprises at least one primary accelerator (c).

18. Tyre according to claim 17, wherein the primary accelerator (c) is selected from thiazoles, sulphenamides, xanthogenates.

19. Tyre according to claim 18, wherein the primary accelerator (c) is selected from sulphenamides.

20. Tyre according to any one of claims 17 to 19, wherein the primary accelerator (c) is present in the elastomeric composition in an amount of from 0.1 phr to 10 phr.

21. Tyre according to claim 20, wherein the primary accelerator (c) is present in the elastomeric composition in an amount of from 0.5 phr to 5 phr.

22. Tyre according to any one of the preceding claims, wherein at least one reinforcing filler is present, in an amount of between 0.1 phr and 120 phr, in the elastomeric composition.

23. Tyre according to Claim 22, wherein the reinforcing filler is carbon black.

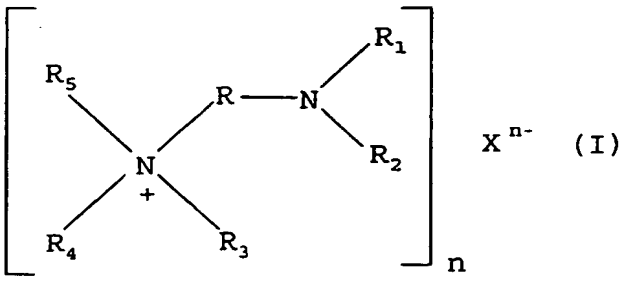
24. Tyre according to Claim 22, wherein the reinforcing filler is silica.

25. Tyre according to Claim 24, wherein the elastomeric composition comprises a silica coupling agent.

26. Tyre tread band including a crosslinkable elastomeric composition comprising:

(a) at least one diene elastomeric polymer;

(b) at least one organic quaternary ammonium salt having the following general formula (I):

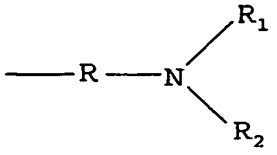


(I)

wherein:

- R represents a linear or branched C_1-C_{22} alkylene group; a linear or branched C_2-C_{22} alkenylene group; a C_6-C_{18} arylene group; a C_7-C_{20} alkylarylene or alkylenearylene group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur;
- R_1 and R_2, which may be identical or different, represent a linear or branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_2, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_5 and/or R_2 and R_3, considered jointly with the nitrogen atoms to which they are linked, represent a C_5-C_{18} heterocyclic ring;
- R_3, R_4 and R_5, which may be identical or different, represent a linear or

branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; a group having the following formula:



wherein R, R_1 and R_2, have the same meanings as disclosed above; or two from R_3, R_4 and R_5, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur;

- X^{n-} represents an inorganic or organic anion group;
- n represents 1, 2 or 3.

27. Tyre tread band according to claim 26, wherein the elastomeric composition is substantially free of additional secondary accelerators.
28. Tyre tread band according to claim 27, wherein the secondary accelerator is diphenyl guanidine (DPG).
29. Tyre tread band according to any one of claims 26 to 28, wherein the organic quaternary ammonium salt (b) is defined according to claims 5 to 12.
30. Tyre tread band according to any one of claims 26 to 29, wherein the diene elastomeric polymer (a) is defined according to claim 13 or 14.
31. Tyre tread band according to any one of claims 26 to 30, wherein the elastomeric composition

comprises at least one elastomeric polymer (a') as defined according to claim 15 or 16.

32. Tyre tread band according to any one of claims 26 to 31, wherein the elastomeric composition comprises at least one primary accelerator (c).

33. Tyre tread band according to claim 32, wherein the primary accelerator (c) is defined according to claims 18 to 21.

34. Tyre tread band according to any one of claims 26 to 33, wherein at least one reinforcing filler is present, in an amount of between 0.1 phr and 120 phr, in the elastomeric composition.

35. Tyre tread band according to claim 34, wherein the reinforcing filler is carbon black.

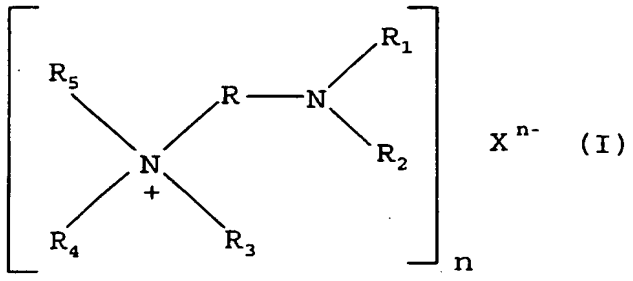
36. Tyre tread band according to claim 34, wherein the reinforcing filler is silica.

37. Tyre tread band according to claim 36, wherein the elastomeric composition comprises a silica coupling agent.

38. Crosslinkable elastomeric composition comprising:

(a) at least one diene elastomeric polymer;

(b) at least one organic quaternary ammonium salt having the following general formula (I):

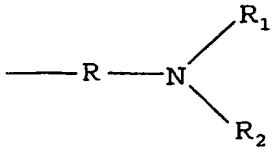


wherein:

- R represents a linear or branched C_1-C_{22} alkylene group; a linear or branched

C_2-C_{22} alkenylene group; a C_6-C_{18} arylene group; a C_7-C_{20} alkylarylene or alkylenearylene group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur;

- R_1 and R_2, which may be identical or different, represent a linear or branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; said groups optionally containing at least one heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_2, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur; or, R_1 and R_5 and/or R_2 and R_3, considered jointly with the nitrogen atoms to which they are linked, represent a C_5-C_{18} heterocyclic ring;
- R_3, R_4 and R_5, which may be identical or different, represent a linear or branched C_1-C_{22} alkyl group; a linear or branched C_2-C_{22} alkenyl group; a C_6-C_{18} aryl group; a C_7-C_{20} arylalklyl or alkylaryl group; a group having the following formula:



wherein R, R_1 and R_2, have the same

meanings as disclosed above; or two from R_3, R_4 and R_5, considered jointly with the nitrogen atom to which they are linked, represent a C_5-C_{18} heterocyclic ring optionally containing a second heteroatom selected from oxygen, nitrogen or sulfur;

- X^{n-} represents an inorganic or organic anion group;
- n represents 1, 2 or 3.

39. Crosslinkable elastomeric composition according to claim 38, wherein the elastomeric composition is substantially free of additional secondary accelerators.

40. Crosslinkable elastomeric composition according to claim 39, wherein the secondary accelerator is diphenyl guanidine (DPG).

41. Crosslinkable elastomeric composition according to any one of claims 38 to 40, wherein the organic quaternary ammonium salt (b) is defined according to claims 5 to 12.

42. Crosslinkable elastomeric composition according to any one of claims 38 to 41, wherein the diene elastomeric polymer (a) is defined according to claim 13 or 14.

43. Crosslinkable elastomeric composition according to any one of claims 38 to 41, wherein the elastomeric composition comprises at least one elastomeric polymer (a') as defined according to claim 15 or 16.

44. Crosslinkable elastomeric composition according to any one of claims 38 to 43, wherein the elastomeric composition comprises at least one primary accelerator (c).

45. Crosslinkable elastomeric composition according

to claim 44, wherein the primary accelerator (c) is defined according to calims 18 to 21.

46. Crosslinkable elastomeric composition according to any one of claims 38 to 45, wherein at least one reinforcing filler is present, in an amount of between 0.1 phr and 120 phr, in the elastomeric composition.

47. Crosslinkable elastomeric composition according to claim 46, wherein the reinforcing filler is carbon black.

48. Crosslinkable elastomeric composition according to claim 46, wherein the reinforcing filler is silica.

49. Crosslinkable elastomeric composition according to claim 48, wherein the elastomeric composition comprises a silica coupling agent.

50. Crosslinked elastomeric manufactured product obtained by crosslinking an elastomeric composition defined according to any one of claims 38 to 49.